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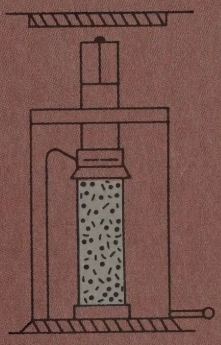
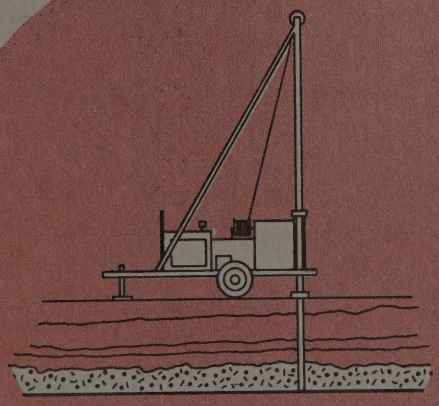
PAVE-FLEX

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION

SOIL MECHANICS
BUREAU





# OVERLAY THICKNESS DETERMINATION

I-690 Hiawatha Blvd. to State Fairgrounds

Onondaga County

P.I.N. 3506.05-111

May 10, 1972

MEMORANDUM
DEPARTMENT OF TRANSPORTATION

DATE May 10, 1972

SUBJECT I-690, HIAWATHA BOULEVARD TO STATE FAIRGROUNDS,
ONONDAGA COUNTY, P.I.N. 3506.05-111,
OVERLAY THICKNESS DETERMINATION

FROM L. H. Moore, Soil Mechanics Bureau, Room 102, Building 7
By: R. J. Weaver

TO M. D. Graham, Facilities Design Subdivision, Room 404, Bldg. 5

CC R. H. Edwards, Prelim. Plan Review Bureau, Room 408, Building 5
J. M. Powers, Regional Director, Region 3
W. P. Hofmann, Technical Services Subdivision, Room 213, Bldg. 7
F. W. Memmott, Program Analysis Bureau, Room 310, Building 5

In accordance with a request dated April 14, 1972, from Mr. Engvold of your office, this Bureau, with the assistance of Regional personnel, has investigated the present serviceability of this section of I-690 and has performed an overlay thickness determination. A summary of the present serviceability survey, a traffic analysis prepared by the Program Analysis Bureau, and our overlay thickness determination are included in this report.

In order to determine the Present Serviceability Index (PSI) of the pavement, one 2000-foot test section was laid out in the outside lane of both the eastbound and the westbound roadways. The PSI determined on the eastbound test section was 2.83, while the westbound test section was found to have a PSI of 2.68. The middle lane of the westbound roadway was noted as being in much worse condition than the test section with respect to rut depth and cracking. Physical measurements of the middle lane were not feasible because of traffic conditions.

Our analysis indicates that, at the present rate of deterioration, a PSI of 2.0 will be reached before the end of the design year (1983). Therefore, we recommend that this pavement be resurfaced with a minimum overlay consisting of 2½ inches of Item 51MF - Asphalt Concrete (mixing method - two course), of which one inch should be Type 1A top and one and one-half inches binder, over a variable thickness of Item 51TL - Asphalt Concrete Truing and Leveling Course.

RJW/ARS/bjg

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NEW YORK STATE DEPARTMENT OF TRANSPORTATION

SOIL MECHANICS BUREAU

I-690, Hiawatha Blvd. to State Fairgrounds
Onondaga County
PIN 3506.05-111

Pavement Serviceability Survey
April 1972

| Test Area | Roughness* (R) ins/mi | Ave. Rut Depth (RD) ins. | Cracking and Patching (C&P) ft/1000 sq. ft. | Present Serviceability Index** (PSI) |
|---|---|---|---|---|
| WB | 107.9 | 0.161 | 22.3 | 2.68 |
| EB | 124.2 | 0.093 | 0.125 | 2.83 |
| Mean | | | | 2.76 |

*Roughness measured by PCA Roadmeter and converted in accordance with correlation between Roadmeter and Roughometer data.

**$Ln(PSI)=1.73-0.0053R-2.67(RD)^2-0.022\sqrt{C\&P}$

MEMORANDUM
DEPARTMENT OF TRANSPORTATION

DATE May 1, 1972

SUBJECT INTERSTATE ROUTE 690
SECTION A1.4 TO A2
ONONDAGA COUNTY

FROM F. W. Memmott, Program Analysis Bureau, Room 301, Bldg. 5

TO W. P. Hofmann, Soils Mechanics Bureau, Room 102, Bldg. 7

ORIGINAL SIGNED BY
H. L. DELEE

To assist you in the preparation of the pavement design analysis for the subject project, we are enclosing ten copies and the original of the necessary traffic analysis.

In summary, we find from our analysis that:

1. The equivalent 18000# axle load estimated to have occurred on one lane of the project pavement from the time of its opening to traffic in 1959 until the time the serviceability index ($P_t$) was reduced to 2.5 (1971) is 5,573,287. The structural number used for this 13-year period is 4.7 and the average daily loading (A.D.L.) was estimated to be 1174.56.

2. The equivalent 18000# axle load estimated to occur on one lane of the project from 1972 to the design year 1983 is 9,088,587. A structural number of 5.0 and a serviceability index ($P_t$) of 2.0 was used for this 12-year period. The A.D.L. for this same 12-year period was estimated to be 2075.02.

FWM:RHD:JED

Enclosures

Traffic Data for Determination
of Overlay Thickness

Project

Interstate Route 690
A1.4 to A2
Onondaga County

Study Limits

This analysis involves a 1.6 mile section of I-690 from A1.4 to A2 (South of Fairgrounds to Hiawatha Boulevard) in Onondaga County.

General Information

Reference, BPR circular memorandum dated May 9, 1967 from G.M. Williams.

The applicable design periods and design years, for the pavement structure, for these estimate section types are restated hereafter.

a) NA
b) NA
c) NA
d) Projects constructed prior to October 24, 1963, with classes of funds other than FAI and accepted into the Interstate System as reasonably meeting the standards of the system for the design year 1975:

The design traffic analysis period for the ultimate structural design may be 20-years from the date of authorization of additional pavement construction. However, for FAI participation, the traffic analysis period is to be 1983 regardless of whether the additional stage construction was authorized in 1964 or is authorized in 1972.

Reference, March 19, 1969 memorandum from G.M. Williams

Establish Traffic Data for the following:

a) The total equivalent 18-kip single axle load applications that will have passed over the traffic lane of the pavement structure during the period of time from its initial opening to traffic to the date when the serviceability index ($P_t$) will be 2.5 and the overlay is to be placed.

b) The total equivalent 18-kip single axle load applications that will have passed over the traffic lane of the pavement structure during the period of time from its initial opening to traffic to the time that the pavement on which an overlay has been placed will have a serviceability index ($P_t$) of 2.0, which traffic and time period are represented in design at least by a 20-year design period.

Lane Distribution

Reference: Highway Capacity Manual, page 106 "on upgrades ---- most of the trucks stay in lane 1, ----"

Assumptions: Ninety-five percent of the lighter trucks use lane 1. One hundred percent of the heavier trucks use lane 1. Since passenger cars have little effect on pavement design, assume forty percent in lane 1 and sixty percent in lane 2.

Section Data: (From Table AW-2)

| Section | Pavement Authorization | Pavement open to traffic | Pavement Design Yr. by Law | Mileage |
|---|---|---|---|---|
| A1.4 - A2 | 1956 | 1959 | 1975 | 1.6 |

AADT (From Interstate Cost Estimates)

| Section | Year open to traffic | 1960* | 1962 | 1965 | 1967 | 1975 | 1990 |
|---|---|---|---|---|---|---|---|
| A1.4 - A2 | 1959 | 14,100 | 18,880 | 16,270 | 16,200 | 49,900 | 50,000 |

| | Open to traffic | $P_t$=2.5 | overlay | Design Year ** |
|---|---|---|---|---|
| Year | 1959 | 1971 | 1972 | 1983 |
| AADT* | 14,000 | 32,200 | 36,400 | 50,000 |

* Obtained from curve
** See general information

DATA FROM TABLE W-1 FOR STATION # 892

| VEHICLE TYPE | 1968 | % TOTAL |
|---|---|---|
| Pass. Cars | 43143 | 79.97 |
| Buses | 312 | .57 |
| Panels & Pickups | 1416 | 2.62 |
| Other 4-tire trucks | 290 | .54 |
| 2-axle 6-tire trucks | 2115 | 3.92 |
| 3-axle trucks | 158 | .30 |
| 3-axle semi-trailers | 599 | 1.12 |
| 4-axle semi-trailers | 3535 | 6.56 |
| 5-axle semi-trailers | 2379 | 4.40 |
| 4-axle full trailers | | |
| | 53947 | 100.00 |

$P_t$ = 2.5  SN = 4.7
Mean AADT 1959 - 1971 = 14000 + 32200/2 = 23100
Directional Mean AADT = 23100/2 = 11,550

| Vehicle Type | % From 1968 W1 | Dist. of ½ AADT 1959-1971 | % Veh. in Lane 1 | Dist. Veh. in Lane 1 | 18K axle* Equiv. $P_t$=2.5 SN=5.0 From W4 Rate/1000 | Converts to 18K axle Equiv. $P_t$=2.5 SN=4.7 Rate/1000 | ADL |
|---|---|---|---|---|---|---|---|
| Passenger Cars | 79.97 | 9236 | 40 | 3694 | 0.8 | 0.85 | 3.14 |
| Buses | 0.57 | 66 | 95 | 63 | 257.0 | 265 | 16.70 |
| Panels & Pickups | 2.62 | 302 | 95 | 287 | 1.8 | 1.93 | 0.55 |
| Other 4-tire trucks | 0.54 | 62 | 95 | 59 | 5.8 | 6.20 | 0.37 |
| 2-axle 6-tire trucks | 3.92 | 453 | 95 | 430 | 132.9 | 139.4 | 59.94 |
| 3-axle trucks | 0.30 | 35 | 95 | 33 | 1285.7 | 1287.8 | 42.50 |
| 3-axle semi-trailers | 1.12 | 130 | 100 | 130 | 378.8 | 389.9 | 50.69 |
| 4-axle semi-trailers | 6.56 | 758 | 100 | 758 | 892.2 | 900.8 | 682.81 |
| 5-axle semi-trailers | 4.40 | 508 | 100 | 508 | 614.4 | 625.7 | 317.86 |
| 4-axle full trailers | 0.00 | | | | | | |
| TOTAL | 100.00 | 11550 | | | | | 1174.56 |

Total 13-year 18000# axle loadings - 13 (365) (1174.56) = 5,573,287
Years 1959 - 1971

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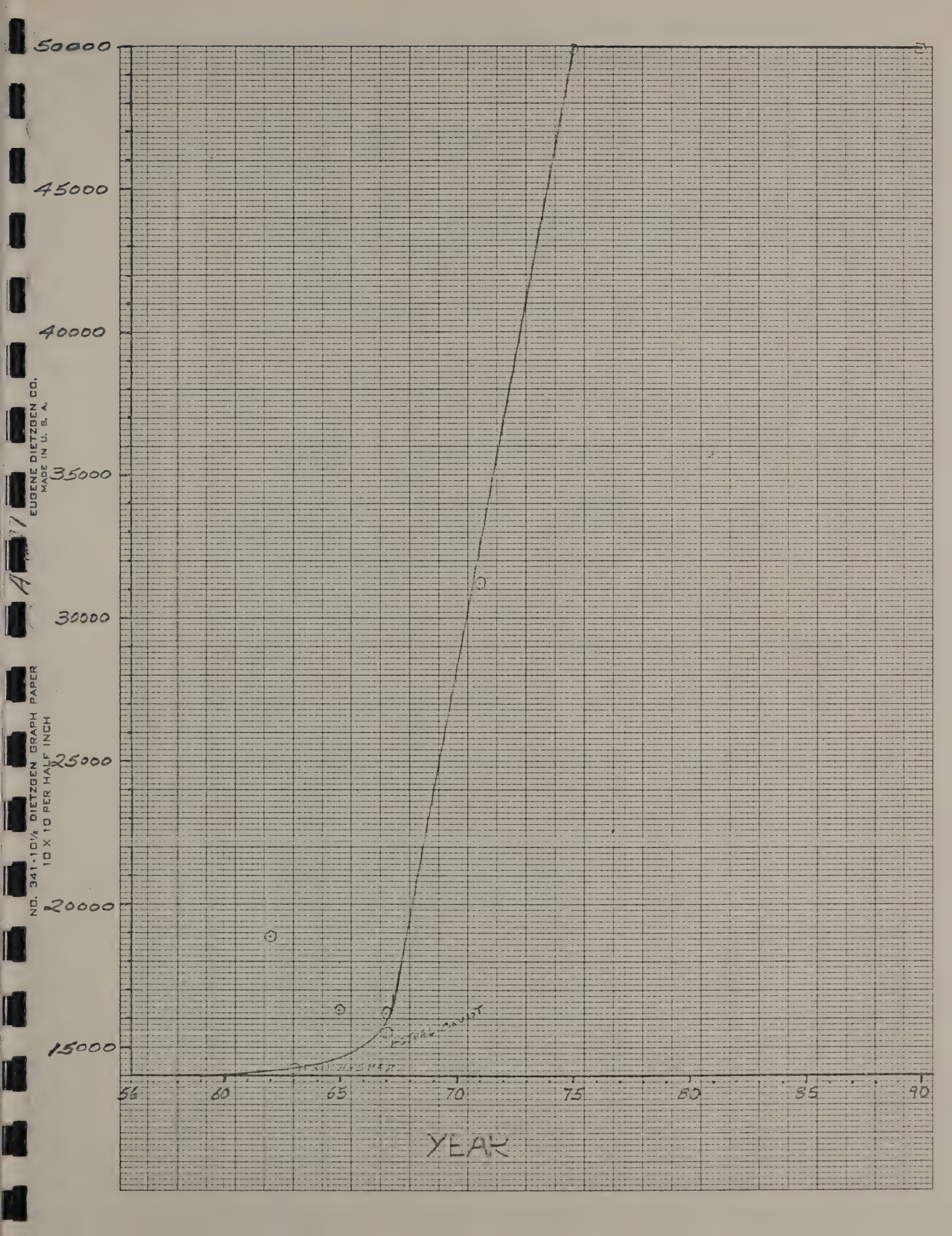
* Used category #6 (1966)

$P_t$ = 2.0 SN= 5
Mean AADT 1972 - 1983 = (36400 + 50000) ÷ 2 = 43200
Directional Mean AADT 21600

| Vehicle Type | % from 1968 W1 | Dist. of ½ AADT 1972-1983 | % Veh. in Lane 1 | Dist. of Veh. in Lane 1 | 18K axle Equiv. $P_t$=2.5 SN=5.0 From W4 Rate/1000 | Converts 18K axle Equiv. $P_t$=2.0 SN=5 Rate/1000 | ADL |
|---|---|---|---|---|---|---|---|
| Passenger Cars | 79.97 | 17273 | 40 | 6909 | 0.8 | 0.7 | 4.84 |
| Buses | 0.57 | 123 | 95 | 117 | 257.0 | 239.0 | 27.96 |
| Panels & Pickups | 2.62 | 566 | 95 | 538 | 1.8 | 1.58 | .85 |
| Other 4-tire trucks | 0.54 | 117 | 95 | 111 | 5.8 | 5.1 | .57 |
| 2-axle 6-tire trucks | 3.92 | 847 | 95 | 805 | 132.9 | 120.2 | 96.76 |
| 3-axle trucks | 0.30 | 65 | 95 | 62 | 1285.7 | 1279 | 79.30 |
| 3-axle semi-trailers | 1.12 | 242 | 100 | 242 | 378.8 | 352 | 85.18 |
| 4-axle semi-trailers | 6.56 | 1417 | 100 | 1417 | 892.2 | 865 | 1225.71 |
| 5-axle semi-trailers | 4.40 | 950 | 100 | 950 | 614.4 | 583 | 553.85 |
| 4-axle full trailers | 0.00 | | | | | | |
| TOTAL | 100.00 | 21600 | | | | | 2075.02 |

Total 12-year 18000# axle loading = 12 (365)(2075.02) = 9,088,587
Years 1972 - 1983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NO. 341-10½ DIETZGEN GRAPH PAPER
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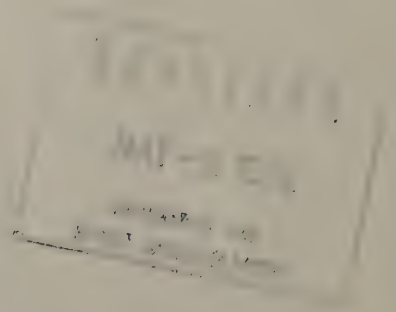

STATE OF NEW YORK DEPARTMENT OF TRANSPORTATION

SOIL MECHANICS BUREAU

PROJECT: I-690 A1.4 to A2
Hiawatha Blvd. to State Fairgrounds
PIN 3506-05-111

Sheet 1 of ..... Sheets
Prepared by: A.R. Schmore Date 5-9-72
Checked by: ..... Date .....

# OVERLAY THICKNESS DETERMINATION

(Ref.: AASHO Interim Guides for the Design of Pavement Structures)

1) Find SN of existing pavement:

| Pavement Section (from plans) | Coeff. of relative strength (a) |
|---|---|
| 2½" AC Surface course | 0.44 |
| 3" Bituminous macadam | 0.34 |
| 4" Broken stone base (Item 45) | 0.14 |
| 5" " " " (Item 41B) | 0.14 |
| 12" Gravel subbase | 0.11 |

$SN = 2.5(0.44) + 3(0.34) + 9(0.14) + 12(0.11) = 4.70$

2) Find year when existing pavement will reach PSI = 2.5:

PSI (April 1972) = 2.76
PSI (1959) assumed to be 4.5

Years to PSI = 2.5:

$$\frac{(2.76-2.5)13}{(4.5-2.76)} = 1.9 \text{ yrs.}$$

PSI will reach 2.5 at end of 1973

SM 273 (12/67)

STATE OF NEW YORK DEPARTMENT OF TRANSPORTATION

SOIL MECHANICS BUREAU

PROJECT: I-690 Hiawatha Blvd. to State Fairgrounds PIN 3506-05-11

Sheet 2 of Sheets

Prepared by: A.R. Schnorr Date 5-10-72

Checked by: Date

3) Find No. of 18 KSEAL's to PSI = 2.5 :

No. of 18 KSEAL's to end of 1971: 5,573,287

" " " from " " "

to end of 1973: $\left(\frac{36,400+41,000}{2}\right)\frac{2}{43,200}(365)(2075.02) = 1,360,000$

6,930,000 18KSEAL's to PSI = 2.5

4) Find Soil Support Value (S):

From nomograph for 6,930,000 18KSEAL's and SN = 4.7

S = 4.15

5) Find No. of 18 KSEAL's to PSI = 2.0 if pavement is not resurfaced:

14,000,000 18KSEAL's

6) Actual anticipated No. of 18 KSEAL's to 1983:

5,573,287 + 9,088,587 = 14,661,874

7) Find SN required to have pavement reach PSI = 2.0 after 14,661,874 18KSEAL's:

SN = 4.73

Strictly following the AASHO Interim Guides, SN has to be increased by 0.03 for the PSI to reach 2.0 at the end of 1983. Minimum overlay thickness that will not peel is considered to be 2.5 inche

SM 373 (12/67)

00286
LRI